I. PATENT ABSTRACTS OF JAPAN

(11)Publication number : **06-035982**
(43)Date of publication of application : **10.02.1994**

(51)Int.Cl. G06F 15/60
G06F 15/64
G06F 15/70

(21)Application number : **04-214591**
(22)Date of filing : **20.07.1992**

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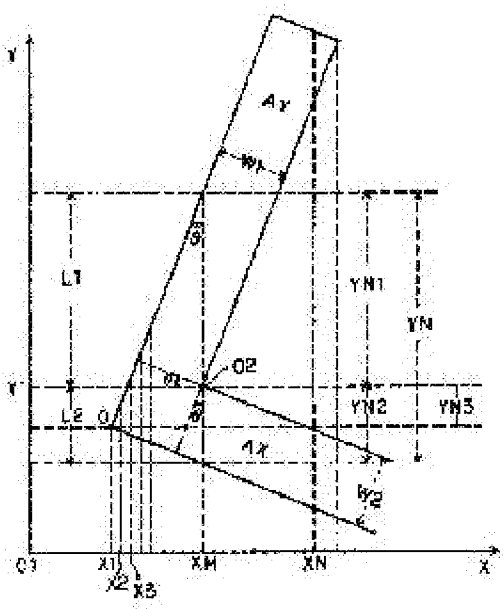
(54) DRAWING MANAGING SYSTEM



(57)Abstract:
PURPOSE: To detect the reference coordinate point of a drawing at a high speed and to correct the inclination of an angle in the case of inputting the drawing at a high speed.
CONSTITUTION: The inside of a memory storing the picture elements of a drawing frame is scanned in an X direction while paying attention to drawing frames AX and AY are plotted in black, the number of black picture elements (histogram) in a Y direction is counted, and the coordinate point, where the histogram first continuously appears, is defined as a reference coordinate point O of the drawing. On the other hand, an inclining angle (correcting angle) θ in the case of inputting the drawing is calculated by a ratio between the number of scanned picture elements in the X direction and the value of the histogram in the Y direction, and the angle is corrected by rotation with the reference coordinate point as the center. Further, the drawing frames are spatially differentiated, line tracking is performed from the reference coordinate point concerning this spatially differentiated image, the inclining angle is calculated, and the angle is corrected.

[JP,06-035982,A] Published February 10, 1994

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]An image reader which reads a drawing.
A memory which stores a pixel which constitutes a picture of a drawing read by this image reader.
A central processing unit which performs data processing between the above-mentioned image reader and the above-mentioned memory, etc.
It is the administration-of-drawings method provided with the above, a histogram about the number of pixels in the above-mentioned memory corresponding to a drawing frame drawn in a drawing by providing an image-processing exclusive processor is counted, and a normal coordinate point of a drawing is searched for based on this counted histogram.

[Claim 2]An image reader which reads a drawing.
A memory which stores a pixel which constitutes a picture of a drawing read by this image reader.
A central processing unit which performs data processing between the above-mentioned image reader and the above-mentioned memory, etc.
By being the administration-of-drawings method provided with the above, and providing an image-processing exclusive processor, A histogram about the number of pixels in the above-mentioned memory corresponding to a drawing frame drawn in a drawing is counted, A normal coordinate point of a drawing is searched for based on this counted histogram, It counts 1 pixel of pixels at a time for inside of a drawing horizontally to this normal coordinate point searched for, Also perpendicularly corresponding to horizontal counted value, a pixel is counted, and a correction angle for amending inclination between a actual drawing and a drawing read by the above-mentioned image reader based on a ratio of horizontal counted value to vertical counted value is searched for.

[Claim 3]An image reader which reads a drawing.
A memory which stores a pixel which constitutes a picture of a drawing read by this image reader.
A central processing unit which performs data processing between the above-mentioned image reader and the above-mentioned memory, etc.
By being the administration-of-drawings method provided with the above, and providing an

image-processing exclusive processor, A histogram about the number of pixels in the above-mentioned memory corresponding to a drawing frame drawn in a drawing is counted, A normal coordinate point of a drawing is searched for based on this counted histogram, spatial differentiation of the drawing frame is carried out, line tracking is performed from a normal coordinate point describing above about this spatial differentiation picture, and angle distortion at the time of a drawing input by the above-mentioned image reader is amended.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention relates to the administration-of-drawings method in the administration-of-drawings system which manages drawings, such as a map and a circuit diagram.
[0002]
[Description of the Prior Art]As drawings, such as a map and a circuit diagram, are generally shown in drawing 5, the drawing frame AV exists in the drawing P, and the figure is drawn in the drawing frame AV. When it stores this drawing P in the memory (not shown) of an administration-of-drawings system, the drawing P is read by image reader IR shown in drawing 6, and the white picture element and black pixel on the drawing P are identified and stored in a memory. Although the reading accuracy of image reader IR differs depending on the model of each image reader, generally the thing of 10 or more dots/mm of accuracy is used now. When reading the drawing P into image reader IR, along with the guide G1 of image reader IR, and G2, the drawing P is usually read, but it is impossible to make the drawing P read completely in parallel with the guide G1 and G2, and the frame and the guide G1 of the drawing P are usually read with the error of the minute angle theta.
[0003]For this reason, as shown in drawing 7, within a memory, the drawing P will be stored in the form where only theta shifted horizontally. Generally the coordinates (X, Y) of the point PO in the drawing P are expressed with the distance of the direction of X of the point PO, and the direction of Y by making into the starting point the point O in drawing 7 which the door post of the drawing P and a transversal frame cross. For this reason, if an error produces only angle theta as mentioned above, about an X coordinate, the error of |a1-a2| will be produced [the case where the drawing frame AV is made into a normal coordinate]. It is the same also about a Y coordinate. In order to amend this error, the Hough (Hough) conversion algorithms are used conventionally. Namely, according to the formula of formal rho=X 0, cos theta+Y 0, and sintheta of Hough transformation, the neighborhood A1 of the vertical axis of the drawing frame AV is scanned, Hough transformation is performed to each pixel of a drawing door post, and the error angle theta is amended from X and Y flat surface by changing into a flat surface (rho, theta) and asking for the angle theta 1 (refer to drawing 8) to the error angle theta on a flat surface (rho, theta). Since the algorithm of the inclination correction by Hough transformation is an algorithm generally used, explanation is omitted here.
[0004]The relation between a rectangular coordinate system and a polar coordinate system is shown in drawing 8. In the X-Y rectangular coordinate system shown in drawing 8 (a), inclination and the point (X0, Y0) of as opposed to [in the distance to the straight line L and theta 1 / 1 / rho] the X-axis of the altitude to the straight line L from the starting point show the intersection of the straight line L and an altitude. In the rho-theta polar coordinate system shown

in drawing 8 (b), a point (rho 1, theta 1) shows the point corresponding to the point (X0, Y0) in drawing 8 (a). Therefore, a relation called rho1=X0, costheta1+Y0, andsintheta1 is materialized.
[0005]
[Problem(s) to be Solved by the Invention]As explained above, in order to perform inclination correction (angle correction) of a actual drawing and the drawing stored in the memory read by the image reader using Hough transformation, by the conventional administration-of-drawings method, trigonometric-functions calculation of costheta or sintheta is needed. In order to perform such functional calculus at high speed, it is necessary to equip an administration-of-drawings system with the hardware only for functional calculus, and it will become expensive in cost. In order to realize by software using CPU in an administration-of-drawings system, it is necessary to perform math processing of costheta and sintheta about each point on a straight line, and administration-of-drawings processing takes much time.
[0006]It was made in order that this invention might solve above SUBJECT, and it aims at providing the administration-of-drawings method which can amend inclination of the drawing at the time of an input at high speed while the normal coordinate point on a drawing is detectable at high speed.
[0007]
[Means for Solving the Problem]In an administration-of-drawings method concerning an invention of claim 1, by forming the image-processing exclusive processor 4, A histogram about the number of pixels in the memory 2 corresponding to a drawing frame drawn in a drawing is counted, and a normal coordinate point of a drawing is searched for based on this counted histogram.
[0008]In an administration-of-drawings method concerning an invention of claim 2, by forming the image-processing exclusive processor 4, Search for a normal coordinate point of a drawing and it counts 1 pixel of pixels at a time for inside of a drawing horizontally to this normal coordinate point searched for, Also perpendicularly corresponding to horizontal counted value, a pixel is counted, and a correction angle which amends inclination between a actual drawing and a drawing read by the image reader 1 is searched for based on a ratio of horizontal counted value to vertical counted value.
[0009]In an administration-of-drawings method concerning an invention of claim 3, by forming the image-processing exclusive processor 4, spatial differentiation of the drawing frame is carried out in quest of a normal coordinate point of a drawing, line tracking is performed from a normal coordinate point about this spatial differentiation picture, and angle distortion at the time of a drawing input by the image reader 1 is amended.
[0010]
[Function]In the invention of claim 1, the image-processing exclusive processor 4 counts the number of the pixels stored in the memory 2 corresponding to a drawing frame, for example, the number of pixels with which a black pixel appears continuously, i.e., a histogram, and searches for the normal coordinate point of a drawing based on the histogram. Therefore, the first point that a black pixel appears continuously turns into a normal coordinate point of a drawing.
[0011]In the invention of claim 2, the correction angle which amends inclination between a actual drawing and the drawing read by the image reader 1 by the ratio of the horizontal counted value from a normal coordinate point to vertical counted value can be found.
[0012]In the invention of claim 3, about a spatial differentiation picture, line tracking is performed and, thereby, the angle distortion at the time of a drawing input is amended from a normal coordinate point.

[0013]
[Example]
Example 1. (claim 1 correspondence)
Drawing 3 is a block diagram showing the example of the administration-of-drawings system which adopted the administration-of-drawings method of this invention. The memory which stores the image reader in which 1 reads a drawing, and the pixel which constitutes the picture of the drawing in which 2 was read by the image reader 1 in drawing 3, CPU to which 3 performs data processing between the image reader 1 and the memory 2, etc. (central processing unit), 4 is an image-processing exclusive processor which performs processing etc. which count the histogram about the number of the pixels in the memory 2 corresponding to the drawing frame drawn in the drawing, and search for the normal coordinate point of a drawing based on this counted histogram.
[0014]Drawing 1 is a figure showing the state of the two-dimensional array within the above-mentioned memory 2 of the drawing frame drawn on the drawing, and the field AX in drawing 1 and AY (drawing frame) are the figures to which the neighborhood of the point O of drawing 5 was expanded. The field AX and the figure containing AY are read by the image reader 1 shown in drawing 3, and are stored as the black pixel and white picture element of a picture in the memory 2 by processing of CPU3. That is, since the field AX and AY (drawing frame) are displayed black in practice, a black pixel is comprised, and other portions comprise a white picture element. Therefore, the logic "1" which shows a black pixel, and the logic "0" which shows a white picture element are stored in the memory 2. In drawing 1, the point O1 shows the drawing end (it corresponds to the point O1 of drawing 5) within the memory 2.
[0015]Since the point X1 is only a white picture element when it counts 1 pixel of histograms (the number of black pixels) of the direction of Y at a time for the inside of the two-dimensional memory 2 by the image-processing exclusive processor 4 in the direction of X, a histogram value is usually "0." Since the point X1 is reached and it becomes the black pixel of a drawing frame, it begins and a histogram counts. The memory addresses at this time (X1, Y1) are coordinates of the point O, and this point O can consider it as the normal coordinate point of a drawing. Since a black pixel may exist as a noise in a drawing, it is necessary to make into a normal coordinate point the point that a histogram increases continuously. That is, since the black pixel detected when the histogram of the direction of Y was set to "0" to the scan of the subsequent direction of X may be a noise even if the number of black pixels counts first, it does not become considering the point of the detection black pixel as a normal coordinate point.
[0016]Example 2. (claim 2 correspondence)
The normal coordinate point O of a drawing (X1, Y1) is detected by the processing mentioned above, and it counts 1 pixel of pixels at a time for the inside of a drawing horizontally (the direction of X) to this normal coordinate point O (X1, Y1), and, also perpendicularly (the direction of Y), a pixel is counted corresponding to horizontal counted value. To X2 after the point X1 of the direction of X, X3, ..., XM, the counted value (histogram) of the black pixel of the direction of Y increases continuously, and if the point XM is exceeded, specifically, it will become constant value. The length equivalent to this constant value turns into the length YN of the direction of Y in drawing 1.
[0017]It is YN=YN1+YN2 and they are YN1=W1/sintheta, and YN2=W2/costheta so that clearly also from drawing 1. However, W1 is the width of the drawing frame AY, and W2 is the width of the drawing frame AX. Generally, the error angle theta is dramatically small and is 3 times or less. At this time, it will be sintheta=0.05 and costheta**1, and if reading accuracy of a

general image reader is set to mm in 16 dots /, it will be about 2 mm, and the width of a common drawing frame is set to W1=W2=32, it will be YN1=640 and YN2=32 and will be set to YN**YN1. It is YN3<YN2 and is set to tantheta=(XM-X1)/(YN1+YN3) **(XM-X1)/YN. However, XM is the point that the histogram value of the direction of Y becomes fixed. Therefore, the error angle theta can be found from the difference of the point X1 which a black pixel counts first, and the point XM that a histogram value becomes fixed, and the counted value YN of the black pixel of the direction of Y in the point XM. That is, the correction angle theta which amends inclination between a actual drawing and the drawing read by the image reader 1 from the ratio of the counted value of the direction of X to the counted value of the direction of Y can be found.

[0018]In the case of this Example 2, calculation of tantheta requires only 1 time, and the conversion to each pixel becomes unnecessary like Hough transformation, and it can attain improvement in the speed of processing. If the error angle theta shown in drawing 1 can be found, angle correction will become possible when only theta carries out the RLC of the drawing frame AX and the AY a center [the point O].

[0019]As shown in drawing 2, drawing frame AX' and when AY inclines, the normal coordinate point OP can be found like the case where it is drawing 1, but this point OP is equivalent to the point OP in drawing 5. In this case, after carrying out angle correction, it can ask for the Y coordinate of the point O in drawing 1 by counting the number of black pixels of the frame of the direction of Y, and drawing a line from the Y coordinate of the point OP to down [of the direction of Y].

[0020]Although it is distinction the case of drawing 1, and in the case of drawing 2, it is distinguishable with the value of the Y coordinate of a normal coordinate point. That is, it is inclination of a drawing frame if it is more than a fixed value with the value of a Y coordinate, as shown in drawing 2, and if it is less than a certain fixed value, it is distinguishable that it is inclination of a drawing frame as shown in drawing 1. The correction angle in the case of drawing 1 is a RLC, and, in the case of drawing 2, it becomes a RRC.

[0021]The value of YN mentioned above, X1, ..., XM, and Y1 grade is inputted by the image reader 1 in drawing 3, and is stored in the memory 2 by CPU3, and a normal coordinate point and the error angle theta are searched for by processing of the image-processing exclusive processor 4.

[0022]Example 3. (claim 3 correspondence)

Next, spatial differentiation of the drawing frame is carried out, line tracking is performed from a normal coordinate point about this spatial differentiation picture, and Example 3 which amends the angle distortion at the time of the drawing input by the image reader 1 is described. By processing explained in Example 1, the normal coordinate point (X1, Y1) shown in drawing 4 is searched for, and this coordinate value is stored in the memory 2. Next, the edge line EG is extracted by carrying out spatial differentiation of the drawing frame AX and the AY for example, by ZOBERU differentiation, If line tracking (tracking) of the pixel on an edge line is carried out in the direction which a Y coordinate increases from the point X1 of the point of this edge line EG, for example, line tracking is carried out to the point XM and the coordinates of the point of the Y coordinate of the edge line EG in the point XM are set to YM, Since the error angle theta can be found in tantheta=(XM-X1)/(YM-Y1), if only theta carries out the RLC of the drawing frame AX and the AY a center [a point (X1, Y1)], the angle distortion at the time of the drawing input by the image reader 1 can be amended.

[0023]

[Effect of the Invention]As mentioned above, by the invention of claim 1, the histogram of a drawing frame is counted and the normal coordinate point of the drawing was searched for based on this histogram.
Therefore, a normal coordinate point can be detected at high speed, and the effect that administration-of-drawings processing accelerates is acquired.

[0024]In the invention of claim 2, it counts 1 pixel of pixels at a time for the inside of a drawing horizontally to the normal coordinate point searched for, Also perpendicularly corresponding to horizontal counted value, a pixel is counted, and the correction angle which amends inclination between a actual drawing and the drawing read by the image reader was searched for based on the ratio of horizontal counted value to vertical counted value.
Therefore, compared with the method using the conventional Hough transformation, inclination of the drawing at the time of an input can be amended at high speed, and the effect that administration-of-drawings processing accelerates is acquired.

[0025]In the invention of claim 3, spatial differentiation of the drawing frame is carried out, line tracking is performed from a normal coordinate point about this spatial differentiation picture, and the angle distortion at the time of the drawing input by an image reader was amended.
Therefore, compared with the method using the conventional Hough transformation, the angle distortion at the time of a drawing input can be amended at high speed, and the effect that administration-of-drawings processing accelerates is acquired.

TECHNICAL FIELD

[Industrial Application]This invention relates to the administration-of-drawings method in the administration-of-drawings system which manages drawings, such as a map and a circuit diagram.

PRIOR ART

[Description of the Prior Art]As drawings, such as a map and a circuit diagram, are generally shown in drawing 5, the drawing frame AV exists in the drawing P, and the figure is drawn in the drawing frame AV. When it stores this drawing P in the memory (not shown) of an administration-of-drawings system, the drawing P is read by image reader IR shown in drawing 6, and the white picture element and black pixel on the drawing P are identified and stored in a memory. Although the reading accuracy of image reader IR differs depending on the model of each image reader, generally the thing of 10 or more dots/mm of accuracy is used now. When reading the drawing P into image reader IR, along with the guide G1 of image reader IR, and G2, the drawing P is usually read, but it is impossible to make the drawing P read completely in parallel with the guide G1 and G2, and the frame and the guide G1 of the drawing P are usually read with the error of the minute angle theta.
[0003]For this reason, as shown in drawing 7, within a memory, the drawing P will be stored in the form where only theta shifted horizontally. Generally the coordinates (X, Y) of the point PO in the drawing P are expressed with the distance of the direction of X of the point PO, and the direction of Y by making into the starting point the point O in drawing 7 which the door post of the drawing P and a transversal frame cross. For this reason, if an error produces only angle theta

as mentioned above, about an X coordinate, the error of |a1-a2| will be produced [the case where the drawing frame AV is made into a normal coordinate]. It is the same also about a Y coordinate. In order to amend this error, the Hough (Hough) conversion algorithms are used conventionally. Namely, according to the formula of formal rho=X 0, cos theta+Y 0, and sintheta of Hough transformation, the neighborhood A1 of the vertical axis of the drawing frame AV is scanned, Hough transformation is performed to each pixel of a drawing door post, and the error angle theta is amended from X and Y flat surface by changing into a flat surface (rho, theta) and asking for the angle theta 1 (refer to drawing 8) to the error angle theta on a flat surface (rho, theta). Since the algorithm of the inclination correction by Hough transformation is an algorithm generally used, explanation is omitted here.
[0004]The relation between a rectangular coordinate system and a polar coordinate system is shown in drawing 8. In the X-Y rectangular coordinate system shown in drawing 8 (a), inclination and the point (X0, Y0) of as opposed to [in the distance to the straight line L and theta 1 / 1 / rho] the X-axis of the altitude to the straight line L from the starting point show the intersection of the straight line L and an altitude. In the rho-theta polar coordinate system shown in drawing 8 (b), a point (rho 1, theta 1) shows the point corresponding to the point (X0, Y0) in drawing 8 (a). Therefore, a relation called rho1=X0, costheta1+Y0, andsintheta1 is materialized.

EFFECT OF THE INVENTION

[Effect of the Invention]As mentioned above, by the invention of claim 1, the histogram of a drawing frame is counted and the normal coordinate point of the drawing was searched for based on this histogram.
Therefore, a normal coordinate point can be detected at high speed, and the effect that administration-of-drawings processing accelerates is acquired.

[0024]In the invention of claim 2, it counts 1 pixel of pixels at a time for the inside of a drawing horizontally to the normal coordinate point searched for, Also perpendicularly corresponding to horizontal counted value, a pixel is counted, and the correction angle which amends inclination between a actual drawing and the drawing read by the image reader was searched for based on the ratio of horizontal counted value to vertical counted value.
Therefore, compared with the method using the conventional Hough transformation, inclination of the drawing at the time of an input can be amended at high speed, and the effect that administration-of-drawings processing accelerates is acquired.

[0025]In the invention of claim 3, spatial differentiation of the drawing frame is carried out, line tracking is performed from a normal coordinate point about this spatial differentiation picture, and the angle distortion at the time of the drawing input by an image reader was amended.
Therefore, compared with the method using the conventional Hough transformation, the angle distortion at the time of a drawing input can be amended at high speed, and the effect that administration-of-drawings processing accelerates is acquired.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]As explained above, in order to perform inclination correction (angle correction) of a actual drawing and the drawing stored in the memory read by

the image reader using Hough transformation, by the conventional administration-of-drawings method, trigonometric-functions calculation of costheta or sintheta is needed. In order to perform such functional calculus at high speed, it is necessary to equip an administration-of-drawings system with the hardware only for functional calculus, and it will become expensive in cost. In order to realize by software using CPU in an administration-of-drawings system, it is necessary to perform math processing of costheta and sintheta about each point on a straight line, and administration-of-drawings processing takes much time.
[0006]It was made in order that this invention might solve above SUBJECT, and it aims at providing the administration-of-drawings method which can amend inclination of the drawing at the time of an input at high speed while the normal coordinate point on a drawing is detectable at high speed.

MEANS

[Means for Solving the Problem]In an administration-of-drawings method concerning an invention of claim 1, by forming the image-processing exclusive processor 4, A histogram about the number of pixels in the memory 2 corresponding to a drawing frame drawn in a drawing is counted, and a normal coordinate point of a drawing is searched for based on this counted histogram.
[0008]In an administration-of-drawings method concerning an invention of claim 2, by forming the image-processing exclusive processor 4, Search for a normal coordinate point of a drawing and it counts 1 pixel of pixels at a time for inside of a drawing horizontally to this normal coordinate point searched for, Also perpendicularly corresponding to horizontal counted value, a pixel is counted, and a correction angle which amends inclination between a actual drawing and a drawing read by the image reader 1 is searched for based on a ratio of horizontal counted value to vertical counted value.
[0009]In an administration-of-drawings method concerning an invention of claim 3, by forming the image-processing exclusive processor 4, spatial differentiation of the drawing frame is carried out in quest of a normal coordinate point of a drawing, line tracking is performed from a normal coordinate point about this spatial differentiation picture, and angle distortion at the time of a drawing input by the image reader 1 is amended.

OPERATION

[Function]In the invention of claim 1, the image-processing exclusive processor 4 counts the number of the pixels stored in the memory 2 corresponding to a drawing frame, for example, the number of pixels with which a black pixel appears continuously, i.e., a histogram, and searches for the normal coordinate point of a drawing based on the histogram. Therefore, the first point that a black pixel appears continuously turns into a normal coordinate point of a drawing.
[0011]In the invention of claim 2, the correction angle which amends inclination between a actual drawing and the drawing read by the image reader 1 by the ratio of the horizontal counted value from a normal coordinate point to vertical counted value can be found.
[0012]In the invention of claim 3, about a spatial differentiation picture, line tracking is performed and, thereby, the angle distortion at the time of a drawing input is amended from a normal coordinate point.

EXAMPLE

[Example]
Example 1. (claim 1 correspondence)
Drawing 3 is a block diagram showing the example of the administration-of-drawings system which adopted the administration-of-drawings method of this invention. The memory which stores the image reader in which 1 reads a drawing, and the pixel which constitutes the picture of the drawing in which 2 was read by the image reader 1 in drawing 3, CPU to which 3 performs data processing between the image reader 1 and the memory 2, etc. (central processing unit), 4 is an image-processing exclusive processor which performs processing etc. which count the histogram about the number of the pixels in the memory 2 corresponding to the drawing frame drawn in the drawing, and search for the normal coordinate point of a drawing based on this counted histogram.
[0014]Drawing 1 is a figure showing the state of the two-dimensional array within the above-mentioned memory 2 of the drawing frame drawn on the drawing, and the field AX in drawing 1 and AY (drawing frame) are the figures to which the neighborhood of the point O of drawing 5 was expanded. The field AX and the figure containing AY are read by the image reader 1 shown in drawing 3, and are stored as the black pixel and white picture element of a picture in the memory 2 by processing of CPU3. That is, since the field AX and AY (drawing frame) are displayed black in practice, a black pixel is comprised, and other portions comprise a white picture element. Therefore, the logic "1" which shows a black pixel, and the logic "0" which shows a white picture element are stored in the memory 2. In drawing 1, the point O1 shows the drawing end (it corresponds to the point O1 of drawing 5) within the memory 2.
[0015]Since the point X1 is only a white picture element when it counts 1 pixel of histograms (the number of black pixels) of the direction of Y at a time for the inside of the two-dimensional memory 2 by the image-processing exclusive processor 4 in the direction of X, a histogram value is usually "0." Since the point X1 is reached and it becomes the black pixel of a drawing frame, it begins and a histogram counts. The memory addresses at this time (X1, Y1) are coordinates of the point O, and this point O can consider it as the normal coordinate point of a drawing. Since a black pixel may exist as a noise in a drawing, it is necessary to make into a normal coordinate point the point that a histogram increases continuously. That is, since the black pixel detected when the histogram of the direction of Y was set to "0" to the scan of the subsequent direction of X may be a noise even if the number of black pixels counts first, it does not become considering the point of the detection black pixel as a normal coordinate point.
[0016]Example 2. (claim 2 correspondence)
The normal coordinate point O of a drawing (X1, Y1) is detected by the processing mentioned above, and it counts 1 pixel of pixels at a time for the inside of a drawing horizontally (the direction of X) to this normal coordinate point O (X1, Y1), and, also perpendicularly (the direction of Y), a pixel is counted corresponding to horizontal counted value. To X2 after the point X1 of the direction of X, X3, ..., XM, the counted value (histogram) of the black pixel of the direction of Y increases continuously, and if the point XM is exceeded, specifically, it will become constant value. The length equivalent to this constant value turns into the length YN of the direction of Y in drawing 1.
[0017]It is YN=YN1+YN2 and they are YN1=W1/sintheta, and YN2=W2/costheta so that clearly also from drawing 1. However, W1 is the width of the drawing frame AY, and W2 is the

width of the drawing frame AX. Generally, the error angle theta is dramatically small and is 3 times or less. At this time, it will be sintheta=0.05 and costheta**1, and if reading accuracy of a general image reader is set to mm in 16 dots /, it will be about 2 mm, and the width of a common drawing frame is set to W1=W2=32, it will be YN1=640 and YN2=32 and will be set to YN**YN1. It is YN3<YN2 and is set to tantheta=(XM-X1)/(YN1+YN3) **(XM-X1)/YN. However, XM is the point that the histogram value of the direction of Y becomes fixed. Therefore, the error angle theta can be found from the difference of the point X1 which a black pixel counts first, and the point XM that a histogram value becomes fixed, and the counted value YN of the black pixel of the direction of Y in the point XM. That is, the correction angle theta which amends inclination between a actual drawing and the drawing read by the image reader 1 from the ratio of the counted value of the direction of X to the counted value of the direction of Y can be found.

[0018]In the case of this Example 2, calculation of tantheta requires only 1 time, and the conversion to each pixel becomes unnecessary like Hough transformation, and it can attain improvement in the speed of processing. If the error angle theta shown in drawing 1 can be found, angle correction will become possible when only theta carries out the RLC of the drawing frame AX and the AY a center [the point O].

[0019]As shown in drawing 2, drawing frame AX' and when AY inclines, the normal coordinate point OP can be found like the case where it is drawing 1, but this point OP is equivalent to the point OP in drawing 5. In this case, after carrying out angle correction, it can ask for the Y coordinate of the point O in drawing 1 by counting the number of black pixels of the frame of the direction of Y, and drawing a line from the Y coordinate of the point OP to down [of the direction of Y].

[0020]Although it is distinction the case of drawing 1, and in the case of drawing 2, it is distinguishable with the value of the Y coordinate of a normal coordinate point. That is, it is inclination of a drawing frame if it is more than a fixed value with the value of a Y coordinate, as shown in drawing 2, and if it is less than a certain fixed value, it is distinguishable that it is inclination of a drawing frame as shown in drawing 1. The correction angle in the case of drawing 1 is a RLC, and, in the case of drawing 2, it becomes a RRC.

[0021]The value of YN mentioned above, X1, ..., XM, and Y1 grade is inputted by the image reader 1 in drawing 3, and is stored in the memory 2 by CPU3, and a normal coordinate point and the error angle theta are searched for by processing of the image-processing exclusive processor 4.

[0022]Example 3. (claim 3 correspondence)

Next, spatial differentiation of the drawing frame is carried out, line tracking is performed from a normal coordinate point about this spatial differentiation picture, and Example 3 which amends the angle distortion at the time of the drawing input by the image reader 1 is described. By processing explained in Example 1, the normal coordinate point (X1, Y1) shown in drawing 4 is searched for, and this coordinate value is stored in the memory 2. Next, the edge line EG is extracted by carrying out spatial differentiation of the drawing frame AX and the AY for example, by ZOBERU differentiation, If line tracking (tracking) of the pixel on an edge line is carried out in the direction which a Y coordinate increases from the point X1 of the point of this edge line EG, for example, line tracking is carried out to the point XM and the coordinates of the point of the Y coordinate of the edge line EG in the point XM are set to YM, Since the error angle theta can be found in tantheta=(XM-X1)/(YM-Y1), if only theta carries out the RLC of the drawing frame AX and the AY a center [a point (X1, Y1)], the angle distortion at the time of

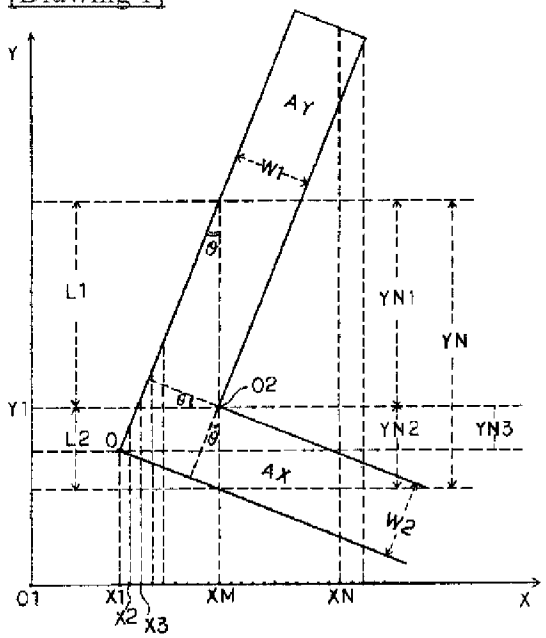
the drawing input by the image reader 1 can be amended.
[0023]

DESCRIPTION OF DRAWINGS

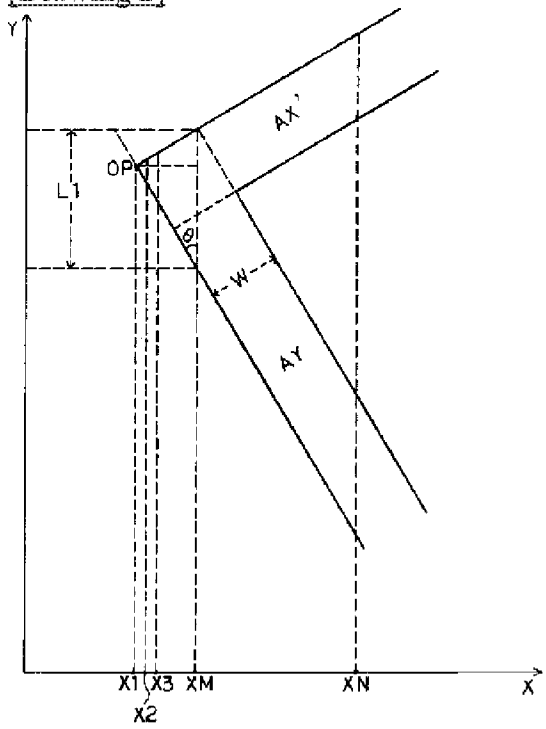
[Brief Description of the Drawings]
[Drawing 1]It is a figure showing the state of the two-dimensional array within the memory of the drawing frame in Examples 1 and 2 by the administration-of-drawings method of this invention.
[Drawing 2]The case where it is shown in drawing 1 is a figure showing the state of the two-dimensional array within the memory of the drawing frame leaning to the opposite direction.
[Drawing 3]It is a block diagram showing the example of the administration-of-drawings system which adopted the administration-of-drawings method of this invention.
[Drawing 4]They are spatial differentiation and an explanatory view which carries out line tracking about the drawing frame in Example 3.
[Drawing 5]It is a figure showing a common map, a circuit diagram, etc.
[Drawing 6]It is a figure for explaining processing by the conventional administration-of-drawings method.
[Drawing 7]It is a figure showing the state of the two-dimensional array within the memory of the drawing frame in this conventional example.
[Drawing 8]It is a figure for explaining Hough transformation.
[Description of Notations]
1 Image reader
2 Memory
3 Central processing unit
4 Image-processing exclusive processor
AX, AY, AX' drawing frame
O and OP Normal coordinate point
theta Correction angle

DRAWINGS

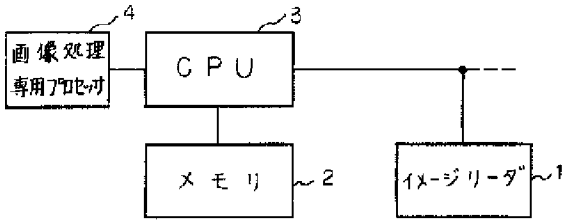
[Drawing 1]



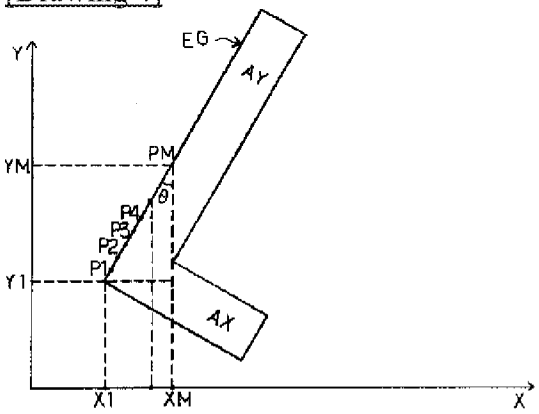
[Drawing 2]



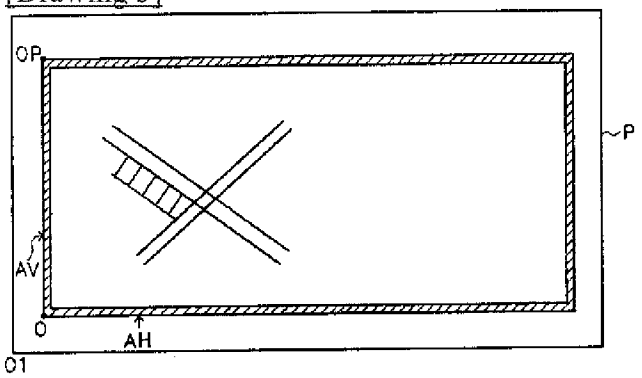
[Drawing 3]



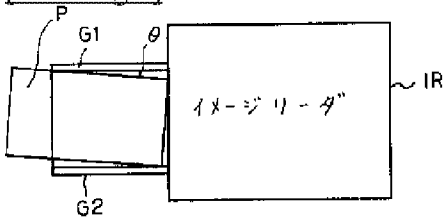
[Drawing 4]



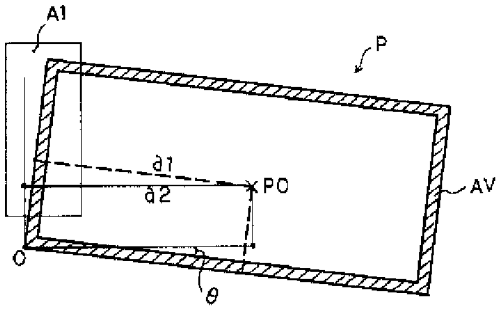
[Drawing 5]



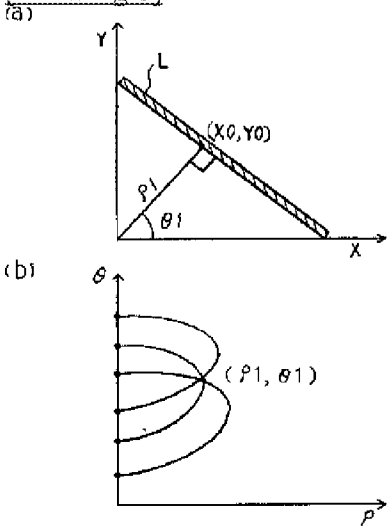
[Drawing 6]



[Drawing 7]



[Drawing 8]



[Translation done.]

Your Ref: 07844-249JP1
Our Ref: PA941

Translation of Selected Portions of
Pat. Laid-open Official Gazette

Appln. No: 4-214591
Appln. Date: July 20, 1992
Laid-open Pub. No: 6-35982
Laid-open Pub. Date: February 10, 1994

Inventor(s): Hatsuhiko Naito
Applicant(s): Mitsubishi Electric K.K.
Attorney(s): Junichi Miyazono

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1. Title of the Invention

SYSTEM FOR MANAGING DRAWINGS

2. Claims

(omitted)

3. Detailed Description of the Invention (Selected Portions)

1)

(omitted)

(19)日本国特許庁（ＪＰ）　(12)**公開特許公報（Ａ）**　(11)特許出願公開番号

特開平6－35982

(43)公開日　平成６年(1994)２月10日

(51)Int.Cl.[5]		識別記号	庁内整理番号	ＦＩ	技術表示箇所
Ｇ０６Ｆ	15/60	３５０　Ｄ	7922－5L		
	15/64	Ａ	9073－5L		
	15/70	３３０　Ｚ	9071－5L		

審査請求　未請求　請求項の数３(全　６　頁)

(21)出願番号　特願平4－214591

(22)出願日　平成４年(1992)７月20日

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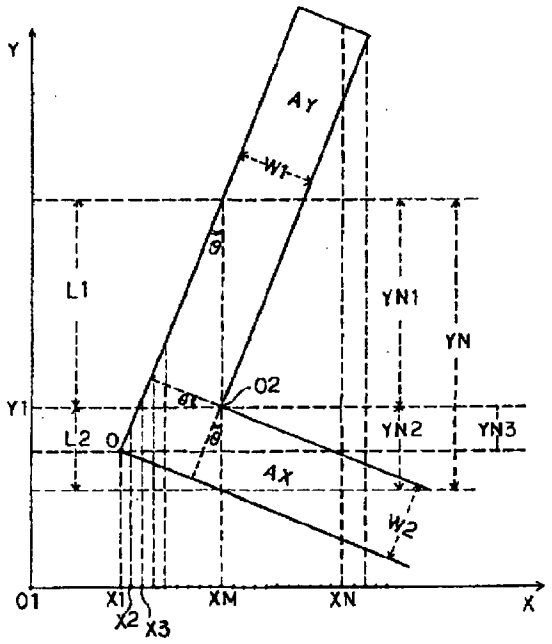
(54)【発明の名称】　図面管理方式

(57)【要約】

【目的】　図面の基準座標点を高速に検出可能にするとともに、図面入力時の角度の傾きを高速に補正できるようにする。

【構成】　図面枠ＡＸ，ＡＹが黒で描画されていることに着目し、図面枠の画素が格納されたメモリ内をＸ方向に走査し、Ｙ方向の黒画素数（ヒストグラム）をカウントし、最初の連続してヒストグラムの表れる座標点を図面の基準座標点Ｏとする。また、Ｘ方向の走査画素数とＹ方向のヒストグラムの値との比により図面の入力時の傾き角（補正角）θを求め、基準座標点を中心として回転することにより角度補正する。また、図面枠を空間微分し、この空間微分画像に関して基準座標点より線追跡を行い、傾き角を求め、角度補正する。



1

【特許請求の範囲】

【請求項1】　図面を読み取るイメージリーダと、このイメージリーダにより読み取られた図面の画像を構成する画素を格納するメモリと、上記イメージリーダと上記メモリ間のデータ処理等を行う中央処理装置とを備えた図面管理システムにおいて、画像処理専用プロセッサを設けることにより、図面内に描かれた図面枠に対応する上記メモリ内の画素の数に関するヒストグラムをカウントし、このカウントされたヒストグラムに基づいて図面の基準座標点を求めることを特徴とする図面管理方式。

【請求項2】　図面を読み取るイメージリーダと、このイメージリーダにより読み取られた図面の画像を構成する画素を格納するメモリと、上記イメージリーダと上記メモリ間のデータ処理等を行う中央処理装置とを備えた図面管理システムにおいて、画像処理専用プロセッサを設けることにより、図面内に描かれた図面枠に対応する上記メモリ内の画素の数に関するヒストグラムをカウントし、このカウントされたヒストグラムに基づいて図面の基準座標点を求め、この求められた基準座標点に対して図面内を水平方向に1画素ずつ画素をカウントし、また水平方向のカウント値に対応して垂直方向にも画素をカウントし、水平方向のカウント値と垂直方向のカウント値の比に基づいて実際の図面と上記イメージリーダで読み取られた図面の間の傾きを補正するための補正角を求めることを特徴とする図面管理方式。

【請求項3】　図面を読み取るイメージリーダと、このイメージリーダにより読み取られた図面の画像を構成する画素を格納するメモリと、上記イメージリーダと上記メモリ間のデータ処理等を行う中央処理装置とを備えた図面管理システムにおいて、画像処理専用プロセッサを設けることにより、図面内に描かれた図面枠に対応する上記メモリ内の画素の数に関するヒストグラムをカウントし、このカウントされたヒストグラムに基づいて図面の基準座標点を求め、図面枠を空間微分し、この空間微分画像に関して上記基準座標点より線追跡を行い、上記イメージリーダによる図面入力時の角度歪みを補正することを特徴とする図面管理方式。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は地図や回路図などの図面を管理する図面管理システムにおける図面管理方式に関するものである。

【0002】

【従来の技術】一般に地図や回路図等のような図面は図5に示されるように図面枠ＡＶが図面Ｐ内に存在し、図面枠ＡＶの中に図形が描かれている。この図面Ｐを図面管理システムのメモリ（図示せず）に格納する場合、図6に示すイメージリーダＩＲにより図面Ｐを読み込み、メモリ内に図面Ｐ上の白画素と黒画素とを識別して格納する。イメージリーダＩＲの読み取り精度は各イメージ

2

リーダの機種によって異なるが、一般に10ドット／mm以上の精度のものが現在使用されている。イメージリーダＩＲに図面Ｐを読み込む際、通常イメージリーダＩＲのガイドＧ1，Ｇ2に沿って図面Ｐを読み込むが、完全にガイドＧ1，Ｇ2に平行に図面Ｐを読み込ませることは不可能であり、通常図面Ｐの枠とガイドＧ1とは微小角θの誤差を持って読み込まれる。

【0003】このため図7に示すようにメモリ内では図面Ｐは水平方向からθだけずれた形で格納されることになる。一般に図面Ｐ内の点ＰＯの座標（Ｘ，Ｙ）は図面Ｐの縦枠と横枠の交わる図7内の点Ｏを原点として点ＰＯのＸ方向，Ｙ方向の距離で表される。このため上述のように角θだけ誤差が生じると図面枠ＡＶを基準座標とした場合に比較して例えばＸ座標に関しては｜ａ1－ａ2｜の誤差を生じる。Ｙ座標に関しても同様である。この誤差を補正するために従来はハフ（Ｈｏｕｇｈ）変換アルゴリズムを利用している。すなわちハフ変換の公式ρ＝Ｘ0・ｃｏｓθ＋Ｙ0・ｓｉｎθの公式に従い例えば図面枠ＡＶの縦軸の近傍Ａ1を走査し、図面縦枠の各画素点に対しハフ変換を施しＸ，Ｙ平面より、（ρ，θ）平面に変換し（ρ，θ）平面上で、誤差角θに対する角θ1（図8参照）を求めることにより誤差角θを補正する。ハフ変換による傾き補正のアルゴリズムは一般に用いられているアルゴリズムであるので、ここでは説明を省略する。

【0004】なお、直交座標系と極座標系の関係は図8に示す。図8（ａ）に示すＸ－Ｙ直交座標系において、ρ1は原点より直線Ｌへの距離、θ1は直線Ｌへの垂線のＸ軸に対する傾き、点（Ｘ0，Ｙ0）は直線Ｌと垂線の交点を示す。また図8（ｂ）に示すρ－θ極座標系において、点（ρ1，θ1）は図8（ａ）中の点（Ｘ0，Ｙ0）に対応する点を示す。したがって、ρ1＝Ｘ0・ｃｏｓθ1＋Ｙ0・ｓｉｎθ1という関係が成立する。

【0005】

【発明が解決しようとする課題】以上説明したように従来の図面管理方式では、実際の図面とイメージリーダで読み取られたメモリに格納される図面との傾き補正（角度補正）はハフ変換を用いて行うため、ｃｏｓθやｓｉｎθの三角関数計算が必要になる。このような関数計算を高速に実行させるためには関数計算専用のハードウェアを図面管理システムに備える必要があり、コスト的に高価なものとなる。また図面管理システム内のＣＰＵを用いソフトウェア的に実現するためには、ｃｏｓθ，ｓｉｎθの数値演算を直線上の各点に関し行う必要があり、図面管理処理に多くの時間を要する。

【0006】この発明は上記のような課題を解決するためになされたもので、図面上の基準座標点を高速に検出することができるとともに入力時の図面の傾きを高速に補正することができる図面管理方式を提供することを目的とする。

【0007】

【課題を解決するための手段】請求項1の発明に係る図面管理方式では、画像処理専用プロセッサ4を設けることにより、図面内に描かれた図面枠に対応するメモリ2内の画素の数に関するヒストグラムをカウントし、このカウントされたヒストグラムに基づいて図面の基準座標点を求めるようになっている。

【0008】請求項2の発明に係る図面管理方式では、画像処理専用プロセッサ4を設けることにより、図面の基準座標点を求め、この求められた基準座標点に対して図面内を水平方向に1画素づつ画素をカウントし、また水平方向のカウント値に対応して垂直方向にも画素をカウントし、水平方向のカウント値と垂直方向のカウント値の比に基づいて実際の図面とイメージリーダ1で読み取られた図面の間の傾きを補正する補正角を求めるようになっている。

【0009】請求項3の発明に係る図面管理方式では、画像処理専用プロセッサ4を設けることにより、図面の基準座標点を求め図面枠を空間微分し、この空間微分画像に関して基準座標点より線追跡を行い、イメージリーダ1による図面入力時の角度歪みを補正するようになっている。

【0010】

【作用】請求項1の発明においては、画像処理専用プロセッサ4は図面枠に対応するメモリ2に格納された画素の数、例えば黒画素が連続して表れる画素の数、即ちヒストグラムをカウントし、そのヒストグラムに基づいて図面の基準座標点を求める。したがって、黒画素が連続して表れる最初の点が図面の基準座標点となる。

【0011】請求項2の発明においては、基準座標点からの水平方向のカウント値と垂直方向のカウント値の比によって、実際の図面とイメージリーダ1で読み取られた図面の間の傾きを補正する補正角が求まる。

【0012】請求項3の発明においては、空間微分画像に関して基準座標点より線追跡が行われ、これにより図面入力時の角度歪みが補正される。

【0013】

【実施例】

実施例1．（請求項1対応）

図3はこの発明の図面管理方式を採用した図面管理システムの実施例を示すブロック図である。図3において、1は図面を読み取るイメージリーダ、2はイメージリーダ1により読み取られた図面の画像を構成する画素を格納するメモリ、3はイメージリーダ1とメモリ2間のデータ処理等を行うCPU（中央処理装置）、4は図面内に描かれた図面枠に対応するメモリ2内の画素の数に関するヒストグラムをカウントし、このカウントされたヒストグラムに基づいて図面の基準座標点を求める処理等を行う画像処理専用プロセッサである。

【0014】図1は図面に描かれた図面枠の上記メモリ

2内での2次元配列の状態を示す図で、図1における領域AX，AY（図面枠）は図5の点Oの近傍を拡大した図である。領域AX，AYを含む図は図3に示すイメージリーダ1によって読み込まれ、CPU3の処理によりメモリ2内に画像の黒画素及び白画素として格納される。即ち、領域AX，AY（図面枠）は、実際は黒で表示されるので黒画素から成り、その他の部分は白画素から成る。したがって、メモリ2には黒画素を示す論理「1」と白画素を示す論理「0」が格納される。また、図1において、点O1はメモリ2内での図面端（図5の点O1に対応）を示す。

【0015】2次元メモリ2内をX方向に1画素ずつY方向のヒストグラム（黒画素数）を画像処理専用プロセッサ4によってカウントすると、点X1までは白画素のみであるのでヒストグラム値は通常「0」である。点X1に達して図面枠の黒画素に達するので、始めてヒストグラムがカウントされる。この時のメモリアドレス（X1，Y1）が点Oの座標であり、この点Oが図面の基準座標点とすることができる。なお、図面内にはノイズとして黒画素が存在することもあるので、ヒストグラムが連続して増大する点を基準座標点とする必要がある。即ち黒画素数が最初にカウントされても、その後のX方向の走査に対してY方向のヒストグラムが「0」になれば検出した黒画素はノイズである可能性があるので、その検出黒画素の点を基準座標点としてはならない。

【0016】実施例2．（請求項2対応）

上述した処理により図面の基準座標点O（X1，Y1）が検出され、この基準座標点O（X1，Y1）に対して図面内を水平方向（X方向）に1画素づつ画素をカウントし、また水平方向のカウント値に対応して垂直方向（Y方向）にも画素をカウントする。具体的には、X方向の点X1以降のX2，X3，・・・，XMに対してはY方向の黒画素のカウント値（ヒストグラム）は増え続け、点XMを越えると一定値になる。この一定値に相当する長さは図1中のY方向の長さYNとなる。

【0017】図1からも明らかなように、YN＝YN1＋YN2であり、YN1＝W1／sinθ，YN2＝W2／cosθである。ただし、W1は図面枠AYの幅、W2は図面枠AXの幅である。一般に誤差角θは非常に小さく、3度以下である。この時、sinθ＝0．05，cosθ≒1であり、一般の図面枠の幅は2mm程度であり、一般のイメージリーダの読み取り精度を16ドット／mmとすると、W1＝W2＝32となり、YN1＝640，YN2＝32であり、YN≒YN1となる。また、YN3＜YN2であり、tanθ＝（XM－X1）／（YN1＋YN3）≒（XM－X1）／YNとなる。ただしXMはY方向のヒストグラム値が一定になる点である。したがって、最初に黒画素がカウントされる点X1とヒストグラム値が一定になる点XMの差と、点XMでのY方向の黒画素のカウント値YNとから誤差

角θが求まる。即ち、X方向のカウント値とY方向のカウント値の比から実際の図面とイメージリーダ１で読み取られた図面の間の傾きを補正する補正角θが求まる。

【００１８】この実施例２の場合、ｔａｎθの計算は１回だけで良く、ハフ変換のように各画素点に対する変換が不要になり、処理の高速化が図れる。図１に示す誤差角θが求まれば、点Ｏを中心としてθだけ図面枠ＡＸ，ＡＹを左回転させることにより、角度補正が可能になる。

【００１９】図２に示すように図面枠ＡＸ’，ＡＹが傾いた場合、図１の場合と同様にして基準座標点ＯＰが求まるが、この点ＯＰは図５中の点ＯＰに対応する。この場合、角度補正した後、Ｙ方向の枠の黒画素数をカウントし、点ＯＰのＹ座標よりＹ方向の下方向へ線を引くことにより、図１中の点ＯのＹ座標を求めることができる。

【００２０】図１の場合と図２の場合の区別であるが、基準座標点のＹ座標の値で区別できる。即ち、Ｙ座標の値がある一定の値以上であれば、図２に示すような図面枠の傾きであり、ある一定の値未満であれば図１に示すような図面枠の傾きであることが区別できる。図１の場合の補正角は左回転であり、図２の場合は右回転になる。

【００２１】上述したＹＮ、Ｘ１，・・・，ＸＭ、Ｙ１等の値は図３におけるイメージリーダ１により入力され、そしてＣＰＵ３によりメモリ２に格納され、基準座標点や誤差角θは画像処理専用プロセッサ４の処理により求められる。

【００２２】実施例３．（請求項３対応）

次に、図面枠を空間微分し、この空間微分画像に関して基準座標点より線追跡を行い、イメージリーダ１による図面入力時の角度歪みを補正する実施例３について説明する。実施例１で説明した処理により、図４に示す基準座標点（Ｘ１，Ｙ１）を求め、この座標値をメモリ２に格納する。次に図面枠ＡＸ，ＡＹを例えばゾーベル微分により空間微分することによりエッジ線ＥＧを抽出し、このエッジ線ＥＧの先の点Ｘ１よりＹ座標の増加する方向にエッジ線上の画素を線追跡（トラッキング）し、例えば点ＸＭまで線追跡し、点ＸＭでのエッジ線ＥＧのＹ座標の点の座標をＹＭとすれば、誤差角θはｔａｎθ＝（ＸＭ－Ｘ１）／（ＹＭ－Ｙ１）で求まるので、点（Ｘ１，Ｙ１）を中心にθだけ図面枠ＡＸ，ＡＹを左回転すれば、イメージリーダ１による図面入力時の角度歪みを補正することができる。

【００２３】

【発明の効果】以上のように請求項１の発明によれば、図面枠のヒストグラムをカウントし、このヒストグラムに基づいて図面の基準座標点を求めるようにしたので、基準座標点を高速に検出することができ、図面管理処理が高速化するという効果が得られる。

【００２４】請求項２の発明によれば、求められた基準座標点に対して図面内を水平方向に１画素ずつ画素をカウントし、また水平方向のカウント値に対応して垂直方向にも画素をカウントし、水平方向のカウント値と垂直方向のカウント値の比に基づいて実際の図面とイメージリーダで読み取られた図面の間の傾きを補正する補正角を求めるようにしたので、従来のハフ変換を用いる方式に比べ、入力時の図面の傾きを高速に補正することができ、図面管理処理が高速化するという効果が得られる。

【００２５】請求項３の発明によれば、図面枠を空間微分し、この空間微分画像に関して基準座標点より線追跡を行い、イメージリーダによる図面入力時の角度歪みを補正するようにしたので、従来のハフ変換を用いる方式に比べ図面入力時の角度歪みを高速に補正でき、図面管理処理が高速化するという効果が得られる。

【図面の簡単な説明】

【図１】この発明の図面管理方式による実施例１，２における図面枠のメモリ内での２次元配列の状態を示す図である。

【図２】図１に示す場合とは逆方向に傾いた図面枠のメモリ内での２次元配列の状態を示す図である。

【図３】この発明の図面管理方式を採用した図面管理システムの実施例を示すブロック図である。

【図４】実施例３における図面枠を空間微分及び線追跡する説明図である。

【図５】一般の地図や回路図等を示す図である。

【図６】従来の図面管理方式による処理を説明するための図である。

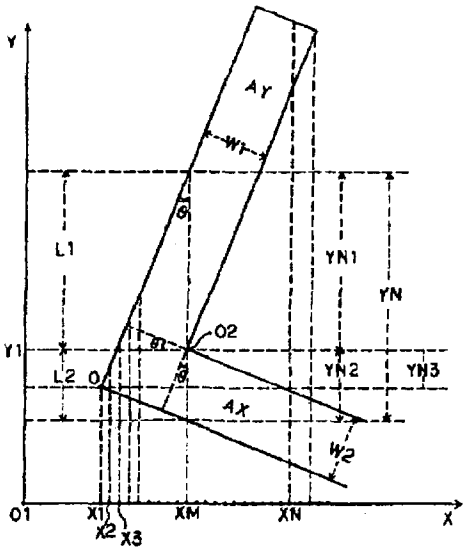
【図７】この従来例における図面枠のメモリ内での２次元配列の状態を示す図である。

【図８】ハフ変換を説明するための図である。

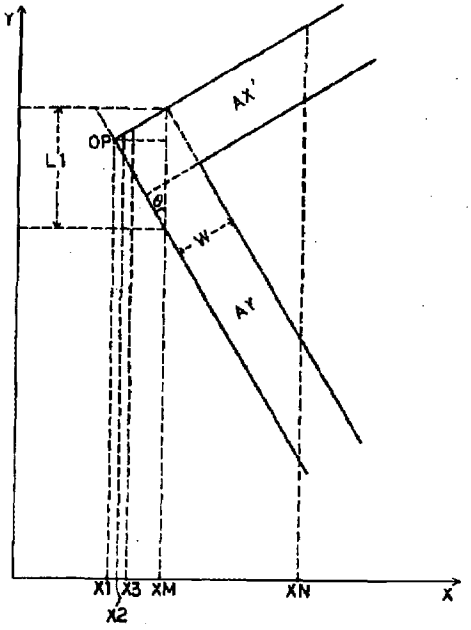
【符号の説明】

１　イメージリーダ
２　メモリ
３　中央処理装置
４　画像処理専用プロセッサ
ＡＸ，ＡＹ，ＡＸ’　図面枠
Ｏ，ＯＰ　基準座標点
θ　補正角

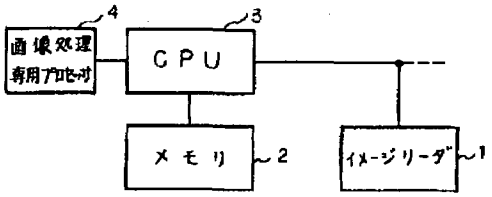
【図１】



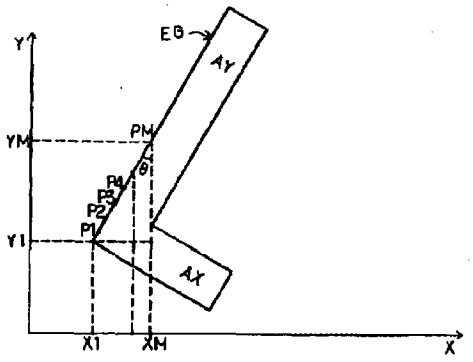
【図２】



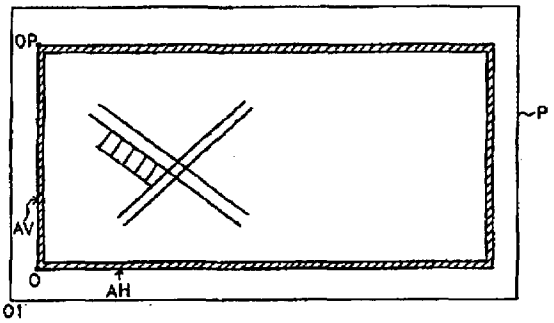
【図３】



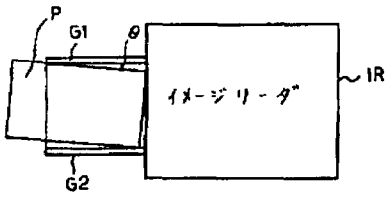
【図４】



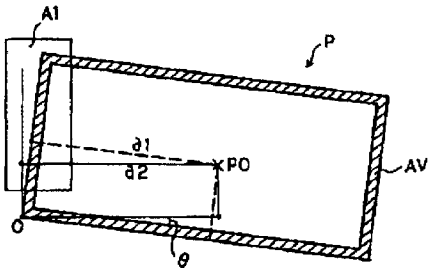
【図５】



【図６】



【図7】



【図8】